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REMARKS

Applicants respectfully request that the amendment be entered in the specification. The amendment enters a description of Hyflow® Supercel and Tonsil®. The description of Hyflow® Supercel appears in US 6,615,991 (col. 6, line 51) and the description of Tonsil® is set forth in A TECHNICAL AND PRACTICAL STUDY OF TONSIL® FILTER AID (copies enclosed).

Applicants deem the amendment to the specification to comply with the Examiner's suggestion. Favorable consideration of the application is respectfully requested.

Respectfully submitted,

Daniel S. Ortiz

Daniel S. Ortiz
(Reg. No. 25,123)
Attorney for Applicants
(215) 628-1141

Cognis Corporation, Patent Dept.
300 Brookside Avenue
Ambler, PA 19002

DSO/ras

Enclosures:
1) U.S. Patent 6,615,991 B1
2) Everett Childers, "A TECHNICAL AND PRACTICAL STUDY OF TONSIL® FILTER AID, Copyrighted by Kelleher Equipment Supply Co., Long Beach, California, (April, 2004), pgs. 1-5

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US006615991B1

(12) **United States Patent**
Rettenmaier

(10) Patent No.: US 6,615,991 B1
(45) Date of Patent: Sep. 9, 2003

(54) FILTER AID

(75) Inventor: Josef Otto Rettenmaier, Rosenberg (DE)

(73) Assignee: Stefan Herzog, Munich (DE)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(58) Field of Search 210/488, 489, 210/490, 491, 503, 504, 505, 506, 507, 508, 500.27, 500.29, 500.1

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Primary Examiner—John Kim
(74) *Attorney, Agent, or Firm*—Foley & Lardner

(57) ABSTRACT

A filter aid, in particular for filtering beverages by means of precoated filters, comprises a mixture of exclusively natural components, e.g. cellulose components. The filter aid is made only of sustainable raw materials and can be degraded almost totally in a natural way.

15 Claims, No Drawings

FILTER AID

Cellulose-based filter aids have been known for a long time ("Ullmann's Encyclopedia of Industrial Chemistry, 3rd edition (1951), first volume, page 492, key word "felted layers" and page 493, key word "filter aids"). Cellulose is produced in a multi-step chemical process, in which all sensorially active materials are removed from the raw material.

Hence filter aids made of pure cellulose are used wherever the sensorial neutrality of the used filter aid is of great significance. Examples of cellulosic filter aids are LEC (low extract cellulose), fine powder cellulose, fine fibrillated cellulose, cationized powder cellulose, fine MCC (microcrystalline cellulose).

In contrast, filter aids made of untreated woodpulp are produced by mechanical comminution, thus only by physical treatment, and can, thus, release extractives (color, odor, flavor) during filtration. Therefore, the use of natural wood fiber-based filters is usually limited to industrial filtrations, where relatively little demand is placed on the sensory analysis. Not only for filtration in the food and luxury food sector, e.g. for sugar solutions (glucose, dextrose, fructose), molasses, dye solutions, fats and oils and the like, but also for many industrial applications, they may be considered only if either the subsequent refining or the complete removal of undesired components (activated charcoal, ion exchanger, etc.) or if the extractives substances cannot have a negative impact on the process (lamination or neutralization due to dyes and odorous substances intrinsic to the process).

The difficult sector of beverage filtration demands, on the one hand, complete sensorial neutrality of the used filter aid; on the other hand, the number of alternatively used filter aids is limited for economic reasons, since the maximum expense for the filter aid is fixed by the price of the mineral filter aids dominating this market.

Usually beverages are filtered in two steps. The first step usually involves mechanical separation methods (e.g. centrifuges) or a coarse filtration, during which operation the liquid usually passes through a precoat layer of a filter aid. This step is frequently followed by a fine filtration operation.

The standard filter aid for filtering by means of a precoated filter in the beverage, especially beer, sector, is kieselguhr. A high percentage of the world beer production is clarified by kieselguhr filtration. Currently it exceeds more than 1.1 billion hl of beer.

It is estimated that the total demand for filter aids worldwide is approximately 1 million tons per year, where inorganic materials, such as kieselguhr, perlite or bentonite, constitute by far the largest share of this amount. Of this total amount about 250,000 tons to 300,000 tons per year are consumed worldwide by the beverage industry, largely by breweries, but also by producers of wine and fruit juices.

To date the number of filter aids, which are based on organic, sustainable raw materials (cellulose, woodpulp, etc.), has been only approx. 60,000 tons per year, even though their use offers a plurality of advantages over inorganic filter aids.

The specific consumption can be up to 70% lower as a result of the low wet cake density (compared to mineral filter aids). At the same time the fibrous structure, the fissured surface and the high porosity often result in a higher flow rate and longer filter life. The structure of plant and cellulose fibers allows the filter to respond elastically to pressure thrusts. They bridge minor defects in the filter cloth; their internal interconnectiveness makes subsequent cleaning of the filter cake easier. Furthermore, the use of organic filter aids presents neither a health risk nor harmful effects for the environment and nature. Pumps and conveying elements of the filtration systems are protected as much as possible owing to the non-abrasive property. Finally the spent filter cakes can be easily disposed, for example, through land management, composting or animal fodder.

Of course, organic filter aids are to some extent many times more expensive than kieselguhr or they exhibit filtration properties that do not completely match those of kieselguhr.

For this reason organic filter aids have not been able to prevail to date against kieselguhr or are used in any case together with kieselguhr (J. Speckner's report "Cellulose as Filter Aids" in the journal "Brauwelt", vol. 124 (1984), issue 46, pages 2058 to 2066, in particular page 2062, left column at the top).

However, using kieselguhr has become increasingly a problem. It arises predominately from the fact that the users have become increasingly more critical in their attitude toward kieselguhr, since diverse studies have suggested in the interim that specific types of kieselguhr pose lung problems.

Strict regulations, which are being asserted and observed more and more in Germany, apply to the handling of kieselguhr.

Another factor is that the disposal of kieselguhr is becoming increasingly more critical in industrial countries. In many places kieselguhr-containing filter residues must be brought to the landfill, a condition that results in a high cost. In contrast, organic filter aids can be tied in again into the natural raw material cycle through composting or animal fodder, a condition that relieves the landfill and provides closed disposal plans.

If contaminated filter cakes from chemical applications have to be fed to thermal utilization, the high ash content and low intrinsic fuel values of mineral filter aids pose a problem.

The result of these urgent problems has been to investigate the possibility of replacing mineral filter aids, especially kieselguhr, when filtering beverages and similar liquids. For a long time, these investigations have paid special attention to using cellulose as a filter aid. Of course, cellulose has been known for a long time as a filter aid. However, for the present invention the issue is using cellulose in the final step of beer filtration which is supposed to largely remove germs and correspondingly stabilize the product (see J. Speckner "Cellulose as a Filter Aid", Brauwelt, vol. 124 (1984), issue 46, pages 2058 to 2066; K. Wackerbauer and R. Gaub "P & S Filtration in Practical Trials", Brauwelt (1989), issue 35, pages 1680–1689).

As a sustainable natural material, cellulose is relatively easy to obtain and passes effortlessly again into the natural cycle without leaving behind any harmful effects.

Therefore, there already exist attempts to provide a filter material that is made exclusively of cellulose and cellulose

derivatives, and that exhibits no components that are harmful to human health or the environment and whose separation efficiency is at least just as high as that of the prior art asbestos-free deep bed filter layers, and that exhibits very few extractable components (DE 43 09 845 C2).

However, the prior art filter aids exhibit a cellulose acetate fiber content ranging up to 50 percent by weight of the total quantity. As a structural component that provides the internal interconnectivity, the cellulose acetate fibers are to be present in a quantity of up to 50% of the total weight of the filter aid. Both microcrystalline and microfine cellulose are distributed homogeneously and embedded in the structure. They can move in the structure and thus have a homogenizing effect on the filter layer.

The requisite cellulose acetate for the filter aid, according to the DE 43 09 845 C2, constitutes a plastic material, which exhibits no natural organic components and is not degradable in the same manner as the cellulose content of this filter aid.

The invention is based on the problem of providing a filter aid, which is made of sustainable raw materials and is naturally degradable.

The problem is solved from one point of view by the invention disclosed herein.

Hence all of the components of the filter aid are to be natural materials, which can pass again into the natural cycle by means of decay or other natural decomposition. That does not mean that the natural organic components may not contain any inorganic contents. However, they should be characterized predominantly by their organic nature. Even cellulose has an ash content of approximately 1.0 percent by weight. Inorganic contents of up to about 5% by weight of the total quantity of the filter aid do not oppose in the present connection classification as an exclusively natural organic component.

How high the percentage of the individual components of the mixture is chosen depends on the type and degree of the loading on the liquid to be filtered, in the case of beer, for example, on the turbidity. If the turbidity is high or the size of particles that are dragged in increases, the percentage of coarser components in the filter aid increases. If the turbidity is low and the particles that are dragged in are finer, the filter layer formed with the filter aid must be denser and thus contains more finer components.

The components of the filter aid are not characterized by their dimensions, because the dimensions for the filtering efficiency of a filter layer, formed with a specific component, are not absolutely conclusive. For the filtering efficiency the shape of the particles of the individual component and their surface properties can have a significant effect.

Therefore, a filter functional value in the form of the water value was chosen to describe the fineness of the mixture. This water value is a measure for the permeability of a filter mass and thus independent of the external formation of the particles of the component consumed.

The water value is determined with a laboratory pressure filter (diameter 50 mm) and an elevated water tank with level control. A 2 m difference must be kept between the level of the water in the elevated water tank and the filter bottom.

The laboratory filter is provided with a wetted, permeable layer of cellulose (Schenk D layer with the sieve side facing downward) and closed. Then 25 g filter aid are slurried in 200 to 300 ml pure water and completely passed into the lab filter. The lab filter is attached to the elevated water tank and purged. After one minute 500 ml water are removed via a filter and then the time for the next 100 ml filtrate is measured. The water value follows from the measured time as follows:

$$\text{water value} = \frac{480}{\text{time in minutes}}$$

If the result is a water value of less than 150, the determination is done as above, but with the use of only 4 g of filter aid. Then the result is:

$$\text{water value} = \frac{76.8}{\text{time in minutes}},$$

Hence the shorter the time, required for a specific volume of water to flow through the filter layer, the higher is the water value.

It has been demonstrated that it is possible to obtain filter aids, whose filter efficiency can reach those of the prior art kieselguhr filters, by combining natural organic components with the corresponding water value of the mixture. At the same time, the entire filter aid is made of sustainable and naturally degradable materials. In the case of the mixture, it is no longer necessary to use extraneous builders.

The invention also addresses the clarity, i.e., the residual turbidity remaining in the filtrate after passing through the filter.

The EBC value is a measure for the turbidity (EBC=European Brewery Convention). An EBC value of up to about 30 means low turbidity; EBC values of about 30 to 120, high turbidity. The turbidity in the experiments was measured using a 90° scatter light photometer KT 30 from Sigrist.

The natural organic components can be cellulose component or be made directly from cellulose, obtained, for example by delignifying wood particles.

One component, which in interaction with cellulosic materials can yield a filtration relevant synergy effect, is a polyglucoside, for example in the form of starch, in particular wheat starch.

All percentages in this text are given as percent by weight (i.e., "wt %").

The use of starch and cellulose per se is described in H. Willmar's article "The Use of Starch and Cellulose" in the journal "Brauwelt" (1985), issue 4, pages 126–129.

Should the liquids be heavily loaded with turbid material, if possible, a significant percentage of coarser cellulose with a water value ranging from 2,500 to 1,200 may be added to the aid.

This cellulose content forms in turn a structure, which prevents the filter aid from disintegrating and prematurely clogging the filter layer with the larger quantity of turbid material.

In many cases, it is also recommended that 20 to 75% cellulose with a water value ranging from 1,200 to 600 be added to the filter aid, hence a somewhat less coarse cellulose for unfiltrate that is not so severely turbid.

It can also be advantageous to add 1 to 30% of cationized cellulose with a water value ranging from 900 to 50 to the filter aid.

Cationized cellulose means a cellulose, where the surface of the particles is treated, for example, with a surfactant or resin. In so doing, the adsorptiveness can be changed as desired. In this manner, components that the filter could not otherwise retain are filtered out of the liquid.

It can be expedient to add to the filter aid a moiety of CTMP (chemical thermal mechanical pulp) and/or a moiety of EFC, i.e., a filter aid, which comprises plant fibers subjected by a special method to a liquid treatment described in the German patent application 197 10 315.4-27, which is incorporated herein by reference.

The water value of this addition is advantageously in the range of 150 to 10.

The water values, may be regarded as orientation values for adjusting the filter aid mixture as a function of the turbidity of the unfiltrate.

The filter aid can exist in the form of pourable material of fine particle size, with which precoat filter layers can be produced, or as a shaped body, i.e., for example as a filter plate.

Filtration with a customary inorganic filter aid is compared with the cellulosic filter aid (Cell. FHM) of the invention below.

Beer with an initial turbidity value of<40 EBC, which was filtered in a precoat filter, serves as the liquid to be filtered.

The experiments were conducted with a laboratory glass filter. In so doing, the first and the second precoat of the filter aid, suspended around water, was pumped in with a metering pump, which, after building up the precoat, also accomplishes the so-called metering, i.e. a constant additional feed of the suspended filter aid during the actual filtration process. The following data in g relate to the quantity of respective material contained in the suspensions yielding the precoats and the metering. The suspension is obtained with the following quantities of water:

a.	first precoat (VA):	8 liters of water
b.	second precoat:	10 liters of water
c.	metering:	10 liters of water

The delivery quantities of the pumps were as follows:

metering pump flow:	7.2 liters per hour
filter pump flow:	40.2 liters per hour

During the respective metering operations the flow of the metering pump was reduced to half. The results were the following precoat periods:

a)	first precoat:	precoat time: 8.4 min.
b)	second precoat:	precoat time: 13.0 min.

During precoating and metering, the following substances were used:

	Coarse Filtration:
Inorganic Filter Aid	
1. Precoat (VA):	46.4 g Hyflow Supercel 18,6 g Harbolite P 400
2. Precoat (VA):	121.2 g Hyflow Supercel 12.3 g Celatom FP1 SL
Metering:	25.6 g Hyflow Supercel 105.3 g Celatom FP1 SL 2.6 g Becofloc 7
Cellulosic Filter Aids	
1. Precoat (VA):	65.0 g ARBOCEL BZN 600-30 PH
2. Precoat (VA):	45.2 g ARBOCEL BNZ 600-30 PH 37.1 g wheat starch PT20002 12.5 g Vivapur 99 2.6 g Becofloc 7
Water value of the kp1 precoat layer	approx. 140
Metering:	analogous to the second precoat
	Fine Filtration
Inorganic Filter Aids	
1. Precoat (VA):	46.4 g Hyflow Supercel 18.6 g Harbolite P 400
2. Precoat (VA):	164.8 g Harbolite P 400 24.6 g Celatom FPI SL 1.0 g Becofloc 10
Metering:	105.3 g Celatom Fp1 SL 2.6 g Becofloc 10
Cellulosic Filter Aids	
1. Precoat (VA):	58.5 g ARBOCEL BZN 600-30 PH 6.5 g ARBOCEL L 600-10
2. Precoat (VA):	59.1 g ARBOCEL BZN 600-30 PH 99.1 g wheat starch C* gel 20006 30.5 g Vivapur 99 2.6 g Becofloc 10
Water value of the kp1 precoat layer	approx. 90
Metering:	32.8 g ARBOCEL BZN 600-30 PH 32.8 g wheat starch C* gel 20006 10.3 g Vivapur 99 2.6 g Becofloc 10

In the tables above the tradenames that are used have the following meaning:

Hyflow Supercel –	kieselguhr from World Minerals
Harbolite P 400 –	perlite from World Minerals
Celatom Fpl SL –	kieselguhr from Eagle Picher
Becofloc 7 –	filter flocs from Begerow
Becofloc 10 –	filter flocs from Begerow
ARBOCEL BZN 600-30 PH –	microfine powder cellulose made of natural fibers
ARBOCEL L 600-10 –	
Vivapur 99 –	microcrystalline cellulose average particle size approx. 50 μm
wheat starch C* gel 23006 –	wheat starch from Cerestar

Given these features of the filter, the comparison filtration yielded the following results, where the differential pressure is equivalent to the flow resistance; for which a measure is—to what extent the filter is clogged and it is approaching the end of its service life. The "turbidity" is equivalent to the clarity of the filtrate.

	Inorganic Filter Aid	Cellulosic Filter Aid
Coarse filtration:		
Differential pressure t = 0 min.	0.3 bar	0.02 bar
Differential pressure t = 150 min.	1.62 bar	0.43 bar
Differential pressure t = 240 min.	no data*	1.77 bar
Turbidity after 150 min.	0.42 EBC	0.70 EBC
Turbidity after 240 min.	No data*	0.52 EBC

*For inorganic filter aids the experiment was discontinued due to too high differential pressure after 150 min.

	Inorganic Filter Aid	Cellulosic Filter Aid
Fine filtration:		
Differential pressure t = 0 min.	0.04 bar	0.02 bar
Differential pressure t > 180 min.	0.63 bar	0.16 bar
Turbidity after 180 min.	0.18 EBC	0.20 EBC

It has been found that the differential pressures after identical filtration periods are significantly lower for the cellulosic filter aid than for the inorganic filter aid, a feature that means that the time of operation before reaching a differential pressure that is no longer acceptable is significantly longer. It also means a saving in filter aids per unit of quantity of the liquid to be filtered. The consumption quantities could be reduced almost 30%, compared to the inorganic filter aid.

What is claimed is:

1. A filter aid for the precoat filtration of beverages, comprising a mixture of:

10 to 75 wt % cellulose with a water value ranging from about 600 to about 150;

10 to 45 wt % cellulose with a water value ranging from about 100 to about 10;

10 to 30 wt % cold water insoluble starch with a water value of <20; and

the remainder up to 100 wt % being additives, wherein the mixture exhibits a water value of <300.

2. A filter aid, as claimed in claim 1 further comprising 5 to 70wt % cellulose With a water value ranging from 2,500 to 1,200 .

3. A filter aid, as claimed in claim 1, further comprising 20 to 70wt % cellulose with a water value ranging from 1,200 to 600.

4. A filter aid, as claimed in claim 1, further comprising 1 to 30wt % cationized cellulose.

5. A filter aid, as claimed in claim 4, wherein the cationized cellulose exhibits a water value ranging from about 900 to about 50.

6. A filter aid, as claimed in claim 1, comprising at least one further polyglucoside besides starch.

7. A filter aid, as claimed in claim 1, comprising an addition of CTMP (Chemical Thermal Mechanical Pulp).

8. A filter aid, as claimed in claim 1, comprising an addition of EFC (Extract-Free Cellulose).

9. A filter aid, as claimed in claim 8, wherein the water value of the EFC ranges from about 600 to about 10.

10. A filter aid, as claimed in claim 1, wherein the water value of the total mixture is<150 when the turbidity of the unfiltrate is equivalent to a EBC (European Brewery Convention) value of up to about 110, and wherein the water value ranges from by about 150 to about 300 when the turbidity of the unfiltrate is equivalent to a EBC value of >110.

11. A filter aid as claimed in claim 1, wherein the filter aid is formed into shaped bodies.

12. A filter aid as claimed in claim 1, wherein the cellulose with a water value ranging from about 100 to about 10, is microcrystalline cellulose.

13. A filter aid as claimed in claim 1, wherein the filter aid is formed into a plurality of layers.

14. A filter aid as claimed in claim 13, wherein at least one of the plurality of layers contains kieselguhr.

15. A filter for the precoat filtration of beverages, comprising a mixture of:

10 to 75 wt % cellulose with a water value ranging from about 600 to about 150;

10 to 45 wt % cellulose with a water value ranging from about 100 to about 10;

10 to 30 wt % cold water insoluble starch with a water value of <20;

a pourable material of fine particle size; and

the remainder up to 100 wt % being additives, wherein the mixture exhibits a water value of <300.

* * * * *

A TECHNICAL AND PRACTICAL STUDY OF TONSIL® FILTER AID

Everett Childers
115 Mockingbird Lane
Tahlequah, OK 74464

A TECHNICAL AND PRACTICAL STUDY OF TONSIL® FILTER AID

An independent observation was done on a filter powder with special properties that reportedly can eliminate distillation of hydrocarbon solvent while preventing odors and dye build-up in a hydrocarbon solvent cleaning system.

The testing and observation of the solvent and equipment was done by Everett Childers of E Childers & Assoc., a nationally known and recognized consultant for the Drycleaners of North America.

Experienced drycleaners using the Tonsil® filter powder included plants that have used the product and method for five months to five years.

The equipment observed for the use of the Tonsil® filter aid and procedures of using the powder were hydrocarbon dry-to-dry, high-speed extract drycleaning machines. It is necessary to use a spin disk filter or a more uncommon flexible or rigid tube filter. This method cannot use conventional cartridge filters as it will plug them up very rapidly due to its unusual properties of being able to filter much finer than is commonly known in the industry.

There are cartridge filters available that will also enable operators to get the same, or similar, results as this study produced.

The drycleaning machines used were 35 to 75 pound hydrocarbon, dry-to-dry units and all were configured to use the Tonsil® filter powder without a still and also without machine installed refrigeration systems. All of the drycleaning machines using the new process were sold and serviced by John Kelleher Equipment Supply, Inc.

The environmental impact of the process and product was investigated and some interesting findings were made. The environmental impact was determined under current United States rules and regulations.

Included parameters were the process's ability to:

Safely clean textile garments to acceptable standards
Not retain any residual solvent odor
Not abnormally increase filter pressure
Permit no carryover of odors or contaminants to garments cleaned.
Produce a completely odor-free and clean garment
Maintain normal flow rate through filters
Produce no still residue problems nor mechanical operation of the still
Reduce hazardous waste produced by process
Maintain garment color to an acceptable degree
Provide a nice hand to the garments cleaned

Not produce wrinkling in garments cleaned
Ability of the process to produce wrinkle free garments
Reduced growth of bacteria in hydrocarbon solvents

BACKGROUND OF TONSIL® FILTER AID

Tonsil® filter powder is produced from bentonite then enhanced by an acid process. This process produces a very fine clay that has highly adsorbent properties for not only odors but dyestuffs and water. The use of the processed bentonite can effectively reduce, or completely eliminate the need to vacuum distill hydrocarbon solvent that has been used during the cleaning process. Bentonite has been used for over 100 years for the clarification of olive and other edible oils and has also been known as Fullers Earth.

The MSDS information does not show any undue hazards for humans working with the powder. It has no effect on the flashpoint of the solvent with which it is used. It has a neutral pH and when viewed under a microscope shows a highly porous inner structure and a multitude of acid sites upon its surface. Tonsil® filter aid will remove traces of acids and polar impurities from solvents. The filtration time shows excellent performance (according to the standard method BE 0013) and averages between 60 and 90 seconds.

COMPARISON OF MACHINE OPERATION WITH AND WITHOUT TONSIL® FILTER AID

The normal drycleaning machine operation includes installing cartridge filters then removing them when they become ineffective in removing insoluble soils. Cartridges with a carbon core are limited in the amount of dyestuffs they can remove from the solvent system. The solvent needs to be distilled on a regular basis to remove soluble impurities. All of this produces an excess amount of hazardous waste that must be legally handled. The conventional method of filtering and distilling solvent is very labor intensive and expensive, with less than desirable results.

With the method of operation that Kelleher Equipment supply, Inc. recommends for solvent maintenance, there is the use of a combination of diatomaceous earth and Tonsil® filter additive placed upon a typical nylon spin disk filter. The Tonsil® filter additive will effectively adsorb dyes, water and solvent soluble soil, moisture and fatty acids from the solvent. It also has inhibiting properties for reducing or eliminating corrosion and bacteriological growth while maintaining a low filter pressure. This process can eliminate the need for distillation.

Since there is no need for distillation, a hydrocarbon cleaning machine may be purchased without a still. With a high-speed extract motor the garments will not be heavily laden with solvent therefore will produce a reduced drying time of the garments. Cycle times are running between 50 and 55 minutes with some loads as low as 47 minutes.

Without a still approximately 3 boiler horse power or more can be saved depending upon distillation practices and size of the machine. With the high-speed extract machine, utilities will be saved due to faster drying times, lack of distillation and eliminating the refrigeration system common to drycleaning machines with a still installed. The drycleaning machine cost can be several thousand dollars less than a machine with a still and refrigeration unit.

TONSIL® FILTER AID SPIN-DISK CLEANING MACHINE OPERATION

The nylon spin disk filter needs to be precoated with a combination of diatomaceous earth and Tonsil® filter additive. This is accomplished by adding a 1.5 dry quart measure of diatomaceous earth and the same amount of Tonsil® filter aid for a 35 pound capacity drycleaning machine's spin disk filter. These powders may be placed on, or in, a cloth bag in the wash wheel. Solvent is brought into the wash wheel and the basket is rotated while sending the wash wheel solvent to the nylon spin disk filter then back to the wash wheel for approximately ten minutes. This coats the disks with diatomaceous earth and Tonsil® filter aid. After this coating of the filter the machine is then ready to clean clothes.

Loads are classified as usual with like fabrics cleaned with like fabrics, mainly by how long it will take to dry the garments. For instance light-weight garments should be cleaned with other light-weight garments and heavy garments with other heavy garments. Heavily soiled garments may be prespotted and flushed as usual.

With the process described above the cleaners observed are running cycle times, for normally soiled garments, between 8 and 20 minutes. Observations of the garments for spots, cleanliness, brightmess, freshness, hand, and lack of wrinkling were all at or above average for the industry.

PRACTICAL CLEANING OF TEXTILES AND THE RESULTS

All of the plants observed were completely free of solvent, bacteria or soil odors. The operators of the systems were pleased with the results they were receiving and noted that spotting was normal, or less, than for a conventionally operated system. They all mentioned the reduced total cycle times and all had reduced their wash times to as low as 8 minutes while still maintaining reduced spotting. Garments spotted did not leave rings due to redeposition.

Classification of garments is primarily by the weight of the garment rather than the color of the garment. All operators mentioned the lack of dye bleed that would redeposit on other garments. On the occasion when a garment would pick-up a stray dye a simple re-cleaning would clear the affected garment without additional work.

After examining fifteen loads that had been removed from the machines after drying, the garments were free of wrinkles, free of any odor, had bright colors and whites. Darker garments

had a depth of color that was apparent. Examination of fifty garments after cleaning, at random produced a total of three stains and two crusty surfaces that were blown off with the steam gun. Including the stains this would produce a 90% pass-up rate for garments cleaned, with no pre-treatment of stains.

One of the cleaners visited had a noticeably darkened sight glass and was asked about it. He reported that the clothes cleaned in the solvent did not show any discoloration from the darkness of the solvent. I examined the garments from the last load he had cleaned and they were all bright with no evidence of redeposition. I asked him to clean it up and he said it would simply take a quart of diatomaceous and a quart of Tonsil® filter aid. After adding the powders it was timed as to how long it would take. After three minutes there was a remarkable difference in the appearance of the solvent. In two more minutes the solvent was completely free of color.

WHAT THE USERS SAY

One of the cleaners visited for information regarding the above described process was Crown Cleaners in Huntington Beach, CA. Mr. Matt Borgerson has used the process for fourteen months with no distillation and reports that he does a regular amount of prespotting. He originally had two perc drycleaning machines and replaced them with new dry-to-dry hydrocarbon machines. The machines have never had the stills turned on due to the effectiveness of the Tonsil® filter additive being able to adsorb dyes, odors and fatty acids from the system. He notes that he has a natural gas reduction of 8%, electricity usage reduction of 23%, and 100% reduction in cartridge costs and disposal costs for cartridges. These cost reductions were calculated after installing two water chillers, a large capacity laundry washer and two drycleaning machines.

Mr. John Marifian of Crown Cleaners (no connection to the company above) in Downey, CA has been in the cleaning business for over 40 years and installed a hydrocarbon dry-to-dry machine using a spin disk filter and Tonsil® filter additive reports that he wouldn't consider going back to petroleum solvent distillation. He reports clarity of solvent, lack of bleeding, excellent cleaning, no odors and excellent hand to the cleaned garments. With the high speed extract machine he said he has not purchased any solvent since installation of the machine over one year ago, which is yielding over 60,000 pounds of cleaning per drum of solvent.

Mr. John Lee of Valencia, CA was a perc cleaner for over 20 years and installed his 2 hydrocarbon machines five months ago and has not used either still in that time, nor does he see a need to, he says. His cleaning cycle is between 10 and 20 minutes with excellent solvent clarity and zippers that actually work on the trousers he cleans. He is reporting utility savings, hazardous waste savings and a boiler HP reduction of 3 HP.

Mr. Gary Futterman of Flair Cleaners in Studio City, CA has cleaned in excess of a million pounds of garments in his high profile cleaners without distillation and with greatly simplified operating procedures. He is doing a load in a total of 57 minutes with exceptional brightness and lack of odors. Spotting is the same as from his perc machine that he uses as a back-up and for heavily soiled garments. When asked his opinion of the Tonsil®/spin disk procedure he

made two statements, "Fantastic" and "Miracle powder".

ENVIRONMENTAL AND ECONOMIC BENEFITS OF TONSIL® FILTER AID

As mentioned by all the cleaners interviewed there was consensus that the hydrocarbon dry-to-dry, high-extract speed machines using diatomaceous filter powder with the additive, Tonsil® filter aid, were above average for cleanliness, brightness and lack of odors for the garments cleaned. None of the cleaners were distilling solvent which results in lower energy costs, elimination of still maintenance and replacement, reduced workload for the operator, no cartridge costs, greatly reduced solvent and filter wastes and a completely odorless working environment. All of their hydrocarbon machines were operating without a costly built-in refrigeration system or still and relied upon the chilled water system to provide the proper temperatures for drying the garments.

The pressers and finishers interviewed also showed a high regard for the clothes cleaned with the process and all stated they pressed easier and faster due to no wrinkling and pleats not being removed during cleaning, and the complete lack of odors of the cleaned garments.

Machine costs can be reduced approximately $10,000.00 by the elimination of a still and refrigerated cooling unit from the price of a new machine. With higher solvent mileage due to a high speed extract and reduced energy and hazardous waste hauling costs this process could pay for a new machine especially if the various states are offering an incentive to switch to a more environmentally correct solvent as does California and some of the eastern states.

In Summary, the filter additive Tonsil® reduces costs by elimination of vacuum distillation equipment, related distillation costs, hazardous or filter waste, labor, and utilities while producing superior cleaning with brighter colors and completely odor free. The process is less costly by eliminating cartridge filters and their ultimate disposal. The drycleaning machine is less complicated, by the elimination of distillation and refrigeration equipment, which will also reduce maintenance costs.

This technical and practical report was prepared by Everett Childers in April, 2004.

Everett Childers of E Childers & Assoc., 115 Mockingbird Lane, Tahlequah, OK 74464.
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